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Description

The present invention relates to a boring apparatus, comprising the features of the preamble of claim 1 (see DE-A-20 25 006). Such a boring apparatus is connectible to a machine tool.

One widely-used used precision boring apparatus comprises a rotatable boring bar, which is attached to and rotatable by, a machine tool spindle. One or more cutting blocks of a given size are connected to the free end of the boring bar, in order to be able to machine a bore of a given diameter. Thus, when it is desired to produce a bore of a different diameter, it is necessary to stop the rotation of the machine tool and to replace the or each cutting block with a different block or blocks to produce a bore of a different diameter. This is very inconvenient, since it requires the provision of a set of many different cutting blocks of different sizes, which is very costly, and which takes up much room in storage. Furthermore, the replacement of the cutting blocks must be performed by a skilled operator, in order that the new cutting block may be correctly set. The stopping of the cutting machine, the replacement of cutting blocks and the recalibration, if necessary, obviously takes a considerable amount of time, and this time is considerably increased when it is realised that for each bore, it is usually necessary to bore in a plurality of stages, usually a roughing stage, a semi-finishing stage and a finishing stage.

It is known to provide cutting blocks having a single cutting tip with a micrometer-adjustable setting. However, the correct setting of such blocks requires a skilled operator, and even then the range of bore sizes which can be produced with such adjustable cutter blocks is only of the order of (1") 2.54cm, which still necessitates the provision of a large number of cutter blocks. Furthermore, if it is desired to cut a bore of a diameter outside the cutting range of the particular cutter, it is necessary to dismantle the assembly, insert a new cutter or cutters, reassemble the apparatus and recalibrate it. Obviously, this is a skilled and time-consuming task.

It is known from, for example, DE 2,025,006 A that profiled bores (e.g. tapering bores) can be formed by a mechanism which is variable during the cutting operation. However, in order to replace the cutters with those of a different cutting range, it is necessary to dismantle the assembly, since the cutter or cutters is/are mounted in a guide slot supporting tube within which an adjusting member is slidably disposed. The advantage gained in being able to vary the cutting diameter is largely lost when it is necessary to replace the cutter or cutters.

It is an object of the present invention to provide a boring apparatus which overcomes the disadvantages described above.

In accordance with the present invention, there is provided a boring apparatus comprising an elongate support body adapted to be rotatable by a machine tool spindle of the type comprising, an adjustment member disposed within said elongate support body and being movable along an axis which is substantially coaxial with the rotational axis of the elongate support body, cutter guide means, a cutter slidably disposed in the cutter guide means and restricted by the guide means to be displaceable along an adjustment axis inclined to the rotational axis of the elongate support body, coupling means at a first end of the adjustment member, the coupling means being releasably securable to a displaceable portion of the machine tool spindle which is extensible and retractable along the rotational axis thereby to advance and retract respectively the adjustment member along the rotational axis, a first coupling component on a second end of the adjustment member opposite to the first end and a second coupling component on the cutter releasably engageable with the first coupling component on the adjustment member, the first and second coupling components comprising a tongue and groove arrangement whose longitudinal axes are inclined to the direction of motion of the adjustment member, whereby movement of the adjustment member along its axis of motion induces movement of the cutter along the adjustment axis, characterised by a cutter support body releasably securable to the end of the elongate support body remote from the machine tool spindle, wherein the cutter guide means is located in the cutter support body and wherein removal of the cutter support body from the end of the elongate support body causes the cutter to be displaced along the adjustment axis as a result of the engagement of the first and second coupling components and means for retaining the cutter in the cutter support body.

Such an arrangement, with the cutter or cutters located in modular fashion to a cutter support body, allows the cutter support body and cutters to be removed from the elongate support body as a whole, and does not necessitate dismantling of the cutters. In order to be able to cut bores of a different diameter range, it is merely necessary to remove the cutter support body housing the cutters, and to replace it with a different support body having cutters capable of boring a different range of diameters.

Preferably, the cutter guide is adapted to receive two cutters. The two cutters may be in slidable engagement with each other.

The cutter support body may further comprise a retaining washer which is releasably securable to the main cutter support body portion. The retaining washer may be provided with passage means for the passage of a portion of the cutter adjustment member.

In a preferred embodiment, the adjustment direction is substantially perpendicular to the rotational axis of the elongate support body.

The cutter adjustment member preferably extends out of, or is extensible out of, the elongate support body within which it is located. This greatly assists the removal and fitting of cutter support bodies and their associated cutters.

By way of example only, a specific embodiment of the present invention will now be described, with reference to the accompanying drawings, in which:-

Fig. 1 is a perspective view, partly cut away, of a first embodiment of boring system embodying the present invention;

Fig. 2 is perspective view of the boring system of Fig. 1;

Fig. 3 is an exploded front perspective view of the cutting head assembly of the boring system of Fig. 1;

Fig. 4 is a rear perspective view of the assembled cutting head assembly of Fig. 3;

Fig. 5 is a front perspective view of the boring system of Fig. 1, with the cutting head assembly removed;

Fig. 6 is an exploded perspective view of part of the boring system of Fig. 1; and

Fig. 7 is a cross-sectional side elevation of part of the assembled cutting head of Fig. 3.

Referring to the figures, the boring system comprises a cylindrical shaft 10 which is provided with a locating flange 12 at one end and cutting means, generally designated as 14, at the opposite end. The locating flange is provided with six apertures 16 which are adapted to receive retaining bolts (not shown) whose heads are received in the apertures and whose threaded shanks are received in correspondingly-positioned threaded apertures in the spindle of a conventional cutting machine. In order that the boring apparatus can be fitted to a plurality of cutting machines, and in particular to a numerically controlled boring machine, an adapter 18, shown in chain dot in Fig. 1, may be provided, and in this case the adapter is secured to the cutting machine and the bolts passing through the apertures 16 in the flange 12 are received in correspondingly-positioned screw-threaded apertures 20 in the adapter.

Referring in particular to Figs. 1, 5 and 6, it will be seen that the cylindrical shaft 10 is hollow, and the interior of the hollow shaft is provided with a generally cylindrical actuator rod 22. The actuator rod 22 is constrained to be movable along the longitudinal axis of the cylindrical shaft 10, and for this purpose two cylindrical support bushes 24, 26 are located on the actuator rod 22. The first of the support bushes 24 is located within the hollow cylindrical shaft 10, and the second support bush 26 which is of a larger diameter than the first support bush 24 is adapted to be received in a correspondingly-shaped aperture 28 in the adapter 18. If an adapter 18 is not necessary, it may be possible to provide a second support bush 26 which is adapted to fit within a corresponding aperture in the spindle of the cutting machine. Each of the bushings has a coating of FIBERSLIP (Trade Mark) which is manufactured by Ampep plc of Clevedon, England, and which produces self-lubricating, high loading, low friction bearings.

The end 30 of the actuator rod adjacent to the second support bush 26 is shaped to be received in a shank 32. The shank 32 has been shown in chain dot since the actual configuration of the shank will be adapted to suit the particular cutting machine. However, in a conventional way, the shank is received and secured in a receiving aperture of a conventional cutting machine, typically a 50 I.S.O. tapered entry. Such conventional cutting machines are adapted to be able to displace the shank along the rotational axis of the cutting machine, normally in order to displace a cutting head longitudinally. In the present case, such displacement will cause the actuator rod 22 to be displaced along this longitudinal axis.

The opposite end of the actuator rod 22 is not cylindrical, but rather is in the form of an actuator end having two generally parallel flat faces. Each face is provided with a plurality of parallel tongues 34 and grooves 36, and it will be noted that the longitudinal axes of the tongues and grooves are inclined to the elongate axis of the cylindrical shaft 10. It will be noted that the tongues and grooves on the opposite faces of the actuating end of the actuating rod 22 are inclined to the elongate axis of the shaft 10 in opposite directions, such that the tongues and grooves on one side rise from the free end of the actuator rod as shown in Figs. 1, 5 and 6, and on the other side the tongues and grooves fall from the said free end. The tongues and grooves are coated with Apticote NEDOX (Trade Mark) produced by A.T. Poeton & Son Limited of Gloucester, England.

Referring to Figs. 1 to 4, the cutting means 14 is in the form of a generally cylindrical support body 38 which is locatable on the free end of the shaft 10 by means of locating teeth 40 on the support body which are engagable with correspondingly-shaped grooves 42 formed in the end of the shaft 10. In use, a shaped washer 44 is located between the support body and the end of

the shaft 10, and is secured thereto by means of two diametrically opposed bolts 45 whose threaded shanks are received in complementarily threaded bores in the support body. The washer is provided with an elongate slot 46 to allow the actuating head of the actuating rod 22 to pass therethrough, and the support body 38 and the washer 44 are securable on the end of the shaft 10 by means of bolts which pass through aligned apertures 48, 50 in the end of the support body 38 and in the washer 44 respectively, and into correspondingly-positioned screw-threaded apertures 51 in the end of the shaft 10.

The support body 38 is provided with a generally rectangular cutter block guide passage 52, whose elongate axis is perpendicular to the longitudinal axis of the shaft 10. The guide passage 52 is adapted to receive two identical cutter blocks 54. The cutter blocks are generally rectangular in cross section, and are provided with planar radially outer faces 56 which in use abut and slide against the faces of the guide passage 52 whose planes extend parallel to the elongate axis of the shaft 10, and against the inner face of the washer 44 which is secured to the body 38. The radially inner faces 58 of the cutter blocks are also generally planar, and are adapted to slide against one another in use. It will thus be noted that the support body 38, the washer 44 and the two cutter blocks 54 form a self-contained unit which may be secured to, and removed from, the end of the shaft 10 as previously described, as a unit, i.e. without the necessity for dismantling the assembly.

It will be noted from the figures that the inner face of each cutter block 58 is provided with a recess 60, the bottom face of the recess being provided with a plurality of tongues 62 and grooves 64 for engagement with the grooves and tongues 36, 34 of the respective faces of the actuating portion of the actuator rod 22.

Thus, it will be noted that, as a result of the engagement of the tongues and grooves 34, 36 of the actuator rod 22 with the complementary grooves and tongues 64, 62 of each cutter block 54, the cutter blocks will be moved radially inwardly or outwardly depending upon the direction of movement of the actuator rod 22, since the cutter blocks 54 are constrained to move in the radial direction only.

The actual cutting is achieved by conventional hard replaceable inserts 66 (such as tungsten carbide) which are releasably securable in respective grooves 68 in each cutter block 54 by means of a bolt 69 (Fig. 4). The cutting inserts are conventional, and will not be described hereinafter.

Thus, each cutting head assembly is capable of cutting holes having diameters within a given range, dependent on the size of the cutting blocks 54. In use, a plurality of pre-assembled cutting head assemblies of overlapping ranges would be provided, and the assembly having the appropriate cutting diameter range is selected and fitted to the end of the shaft 10. This is done by manoeuvring the cutting head assembly to locate the distal end of the actuating rod (which extends beyond the end of the shaft 10 when the cutting head assembly is removed, as shown in Fig. 5, thereby facilitating this operation in the slot 46 and to engage the tongues and grooves 34, 36 of the actuating rod with the grooves and tongues 64, 62 in the cutting blocks 54.

As the tongues and grooves are engaged further by pushing the assembly onto the end of the shaft 10 to engage the locating teeth 40 of the assembly with the recesses 42 on the shaft, the cutter blocks are automatically moved to the correct radial position for the given longitudinal position of the actuating rod 22, by virtue of the wedge action of the tongues and grooves. Thus, re-calibration of the cutting blocks is unnecessary, and fitting of the cutting head assembly is extremely rapid, accurate and does not require skilled labour.

In use, the desired cutting diameter within the range of diameters for a given assembly is set by moving the actuator rod 22 in its longitudinal direction. Movement of the actuator rod 22 away from the cutting means 14 causes the cutting blocks to be drawn radially inwards, whereas movement of the actuator rod 22 in the opposite direction causes radially outward movement. By suitable adjustment of the actuator rod 22, as moved by the shank connected to the numerically controlled machine tool, the desired cutting diameter may be accurately controlled. Indeed, by suitable calibration of the cutting machine, the cutting diameter may be set automatically by entering the required diameter, which produces a corresponding known displacement of the actuator rod and hence corresponding radial movement of the cutter blocks 54.

Each cutting head assembly comprising two cutter blocks 54 a support body 38 and a washer 44 secured to the support body 38 can thus be used to bore holes having diameters over a fixed range, and the actual diameter may be easily and accurately varied. If the required diameter is outside the range required, it is a simple matter to replace the cutting head assembly as a unit, and replace it with an assembly having cutter blocks which are either larger or smaller to provide a different range of diameters. In this regard, it will be noted that, as the support body 38 is removed from the end of the shaft 10, it will cause the cutter blocks 54 to be drawn radially inwardly to their minimum diameter. In this position, spring-loaded ball bearings 80 located in axial bores 82 in the support body 38 seat themselves in part-spherical

recesses 72 located in the edge of the cutter blocks 54, to retain the cutter blocks at their minimum diameter positions, and to prevent them from falling out of the support body 38. The ball bearings are acted upon by respective compression springs 84 having a 10lb pre-load, and one end of the bore is closed off by a grub screw 86. The cutting head assemblies not in use are thus stored in this configuration, making the subsequent attachment of a desired assembly very rapid and accurate. Damage to the apparatus by excessive movement of the actuator rod 22 may be prevented by providing the actuator rod 22 with an axial extending slot 74. A peg (not illustrated) may then be releasably secured in a bore 76 in the shaft 10, thereby limiting the axial movement of the actuator rod 22.

It will be noted that, as a result of the rapid and accurate variation of the diameter which is possible with the present boring apparatus, it will be possible to machine profiled objects in a single machining operation. Also, it is envisaged that, by a suitable measurement feedback system, a computer-controlled machine tool will be able to vary the position of the cutter blocks 54 to compensate for wear of the cutting inserts 66 during machining, thereby obtaining a truly accurate diameter of bore, even when wear of the inserts 66 takes place. It should also be noted that this boring apparatus is not restricted to use with horizontal boring machines, but may be adapted with other cutting machines, such as vertical axis cutting machines.

As mentioned previously, the present boring apparatus is particularly useful not only for straightforward boring and threading operations, but is also particularly useful for producing contours, where gradual and continuous variation of cutting diameter is required. The use of two cutters also produces greater accuracy, and at the same time allows increased cutting speeds and higher feed rates.

Claims

1. A boring apparatus comprising an elongate support body (10) adapted to be rotatable by a machine tool spindle of the type comprising, an adjustment member (22) disposed within said elongate support body and being movable along an axis which is substantially coaxial with the rotational axis of the elongate support body (10), cutter guide means (52), a cutter (54) slidably disposed in the cutter guide means and restricted by the guide means to be displaceable along an adjustment axis inclined to the rotational axis of the elongate support body (10), coupling means (32) at a first end of the adjustment member (22), the coupling means being releasably securable to a displaceable portion of the machine tool spindle which is extensible and retractable along the rotational axis thereby to advance and retract respectively the adjustment member (22) along the rotational axis, a first coupling component (34,36) on a second end of the adjustment member (22) opposite to the first end and a second coupling component (62,64) on the cutter (54) releasably engageable with the first coupling component (34,36) on the adjustment member (22), the first and second coupling components comprising a tongue and groove arrangement whose longitudinal axes are inclined to the direction of motion of the adjustment member, whereby movement of the adjustment member (22) along its axis of motion induces movement of the cutter (54) along the adjustment axis, characterized by a cutter support body (38) releasably securable to the end of the elongate support body (10) remote from the machine tool spindle, wherein the cutter guide means (52) is located in the cutter support body (38) and wherein removal of the cutter support body (38) from the end of the elongate support body (10) causes the cutter (54) to be displaced along the adjustment axis as a result of the engagement of the first and second coupling components (34, 36; 62, 64), and means (72, 80, 84) for retaining the cutter (54) in the cutter support body.

2. A boring apparatus as claimed in claim 1, whereby removal of the cutter support body (38) from the end of the elongate support body (10) disengages the first (34,36) and second (62,64) coupling components of the adjustment member (22) and the cutter (54) respectively.

3. A boring apparatus as claimed in claim 1 or claim 2, wherein the cutter support body (38) is adapted to receive two cutters (54).

4. A boring apparatus as claimed in claim 3, wherein the two cutters (54) are in slidable engagement with each other.

5. A boring apparatus as claimed in any of the preceding claims, wherein the cutter support body (38) further comprises a retaining washer (44) which is releasably securable to the main cutter support body portion.

6. A boring apparatus as claimed in claim 5, wherein the retaining washer is provided with passage means (46) for the passage of a portion of the cutter adjustment member (22).

7. A boring apparatus as claimed in any of the preceding claims, wherein the adjustment direction is substantially perpendicular to the rotational axis of the elongate support body (10).

8. A boring apparatus as claimed in any of the preceding claims, wherein the cutter adjustment member (22) extends out of, or is extensible out of, the elongate support body (10) within which it is located.

9. A boring apparatus as claimed in any of the preceding claims, wherein for retaining the cutter (54) in the cutter support body (38) comprises a detent mechanism.

Patentansprüche

1. Bohrgerät, umfassend ein längliches Stützgehäuse (10), das von einer Werkzeugmaschinenspindel des Typs gedreht werden kann, der ein Verstellelement (22) aufweist, das in dem länglichen Stützgehäuse angeordnet und entlang einer Achse beweglich ist, die im wesentlichen koaxial zur Rotationsachse des länglichen Stützgehäuses (10) ist, ein Schneidvorrichtungs-Führungsmittel (52), eine Schneidvorrichtung (54), die verschiebbar in dem Schneidvorrichtungs-Führungsmittel angeordnet ist und durch das Führungsmittel so beschränkt wird, daß sie entlang einer zur Rotationsachse des länglichen Stützgehäuses (10) hin geneigten Verstellachse verschiebbar ist, ein Kupplungsmittel (32) am ersten Ende des Verstellelementes (22), wobei das Kupplungsmittel lösbar an einem verschiebbaren Abschnitt der Werkzeugmaschinenspindel befestigt ist, die entlang der Rotationsachse ein- und ausfahrbar ist, um so jeweils das Verstellelement (22) entlang der Rotationsachse vor- und zurückzubewegen, eine erste Kupplungskomponente (34, 36) an einem zweiten Ende des Verstellelementes (22) gegenüber dem ersten Ende und eine zweite Kupplungskomponente (62, 64) an der Schneidvorrichtung (54), die lösbar mit der ersten Kupplungskomponente (34, 36) an dem Verstellelement (22) in Eingriff gebracht werden kann, wobei die erste und die zweite Kupplungskomponente eine Nut- und Federanordnung aufweist, deren Längsachsen in der Bewegungsrichtung des Verstellelementes hin geneigt sind, so daß eine Bewegung des Verstellelementes (22) entlang seiner Bewegungsachse die Bewegung der Schneidvorrichtung (54) entlang der Verstellachse induziert, gekennzeichnet durch ein Schneidvorrichtungs-Stützgehäuse (38), das lösbar mit dem Ende des länglichen Stützgehäuses (10) befestigt ist, das von der Werkzeugmaschinenspindel entfernt ist, wobei sich das Schneidvorrichtungs-Führungsmittel (52) in dem Schneidvorrichtungs-Stützgehäuse (38) befindet und wobei ein Entfernen des Schneidvorrichtungs-Stützgehäuses (38) von dem Ende des länglichen Stutzgehäuses (10) eine Verschiebung der Schneidvorrichtung (54) entlang der Verstellachse auf Grund des Eingriffes des ersten und des zweiten Kupplungselementes (34, 36; 62, 64) bewirkt, und durch Mittel (72, 80, 84) zum Halten der Schneidvorrichtung (54) in dem Schneidvorrichtungs-Stützgehäuse.

2. Bohrgerät nach Anspruch 1, wobei das Entfernen des Schneidvorrichtungs-Stützgehäuses (38) von dem Ende des länglichen Stützgehäuses (10) ein Auskuppeln der ersten (34, 36) und der zweiten (62, 64) Kupplungskomponente des Verstellelementes (22) bzw. der Schneidvorrichtung (54) bewirkt.

3. Bohrgerät nach Anspruch 1 oder Anspruch 2, wobei das Schneidvorrichtungs-Stützgehäuse (38) zwei Schneidvorrichtungen (54) aufnehmen kann.

4. Bohrgerät nach Anspruch 3, wobei sich die beiden Schneidvorrichtungen (54) in Gleiteingriff miteinander befinden.

5. Bohrgerät nach einem der vorhergehenden Ansprüche, wobei das Schneidvorrichtungs-Stützgehäuse (38) außerdem eine Haltescheibe (44) aufweist, die lösbar an dem Hauptabschnitt des Schneidvorrichtungs-Stützgehäuses befestigt werden kann.

6. Bohrgerät nach Anspruch 5, wobei die Haltescheibe mit einem Kanal (46) für den Durchlauf eines Abschnittes des Schneidvorrichtungs-Verstellelementes (22) versehen ist.

7. Bohrgerät nach einem der vorhergehenden Ansprüche, wobei die Verstellrichtung im wesentlichen lotrecht zur Rotationsachse des länglichen Stützgehäuses (10) liegt.

8. Bohrgerät nach einem der vorhergehenden Ansprüche, wobei das Schneidvorrichtungs-Verstellelement (22) aus dem länglichen Stützgehäuse (10), in dem es sich befindet, heraus verläuft oder aus diesem ausgefahren werden kann.

9. Bohrgerät nach einem der vorhergehenden Ansprüche, das zum Halten der Schneidvorrich-

tung (54) in dem Schneidvorrichtungs-Stützgehäuse (38) einen Arretiermechanismus aufweist.

Revendications

1. Appareil de perçage comportant un corps de support allongé (10) adapté pour être rotatif par une broche de machine-outil du type comportant, un élément de réglage (22) disposé à l'intérieur dudit corps de support allongé et étant déplaçable le long d'un axe qui est sensiblement coaxial à l'axe de rotation du corps de support allongé (10), un moyen de guide de coupoir (52), un coupoir (54) disposé de façon coulissante dans le moyen de guide de coupoir et limité par le moyen de guide pour être déplaçable le long d'un axe de réglage incliné vers l'axe de rotation du corps de support allongé (10), un moyen de couplage (32) à une première extrémité de l'élément de réglage (22), le moyen de couplage pouvant être fixé de façon relâchable à une portion déplaçable de la broche de machine-outil qui est extensible et rétractible le long de l'axe de rotation, afin de respectivement avancer et rétracter l'élément de réglage (22) le long de l'axe de rotation, un premier élément de couplage (34,36) sur une deuxième extrémité de l'élément de réglage (22) en face de la première extrémité et un deuxième composant de couplage (62,64) sur le coupoir (54) enclenchable de façon relâchable avec le premier composant de couplage (34,36) sur l'élément de réglage (22), le premier et le deuxième composants de couplage comportant une disposition de langue et de rainure dont les axes longitudinaux sont inclinés vers la direction de mouvement de l'élément de réglage, de sorte que le déplacement de l'élément de réglage (22) le long de son axe de mouvement induit le déplacement du coupoir (54) le long de l'axe de réglage, caractérisé par un corps de support de coupoir (38) pouvant être fixé de façon relâchable à l'extrémité du corps de support allongé (10) reculé de la broche de machine-outil, dans lequel le moyen de guide de coupoir (52) est situé dans le corps de support de coupoir (38) et dans lequel l'enlèvement du corps de support de coupoir (38) de l'extrémité du corps de support allongé (10) provoque le déplacement du coupoir (54) le long de l'axe de réglage en conséquence de l'enclenchement du premier et du deuxième éléments de couplage (34, 36; 62, 64), et des moyens (72, 80, 84) pour retenir le coupoir (54) dans le corps de support de coupoir.

2. Appareil de perçage selon la revendication 1, dans lequel l'enlèvement du corps de support de coupoir (38) de l'extrémité du corps de support allongé (10) désenclenche le premier (34,36) et le second (62,64) composants de couplage, respectivement de l'élément de réglage (22) et du coupoir (54).

3. Appareil de perçage selon la revendication 1 ou 2, dans lequel le corps de support de coupoir (38) est adapté pour recevoir deux coupoirs (54).

4. Appareil de perçage selon la revendication 3, dans lequel les deux coupoirs (54) sont d'un enclenchement coulissant l'un avec l'autre.

5. Appareil de perçage selon l'une quelconque des revendications précédentes, dans lequel le corps de support de coupoir (38) comporte en outre une rondelle de retenue (44) qui peut être fixée de façon relâchable à la portion principale de corps de support de coupoir.

6. Appareil de perçage selon la revendication 5, dans lequel la rondelle de retenue est dotée d'un moyen de passage (46) pour le passage d'une portion de l'élément de réglage de coupoir (22).

7. Appareil de perçage selon l'une quelconque des revendications précédentes, dans lequel la direction de réglage est sensiblement perpendiculaire à l'axe de rotation du corps de support allongé (10).

8. Appareil de perçage selon l'une quelconque des revendications précédentes, dans lequel l'élément de réglage de coupoir (22) s'étend hors du, ou est extensible hors du corps de support allongé (10) à l'intérieur duquel il est placé.

9. Appareil de perçage selon l'une quelconque des revendications précédentes, dans lequel pour retenir le coupoir (54) dans le corps de support de coupoir (38), un mécanisme d'arrêt est inséré.

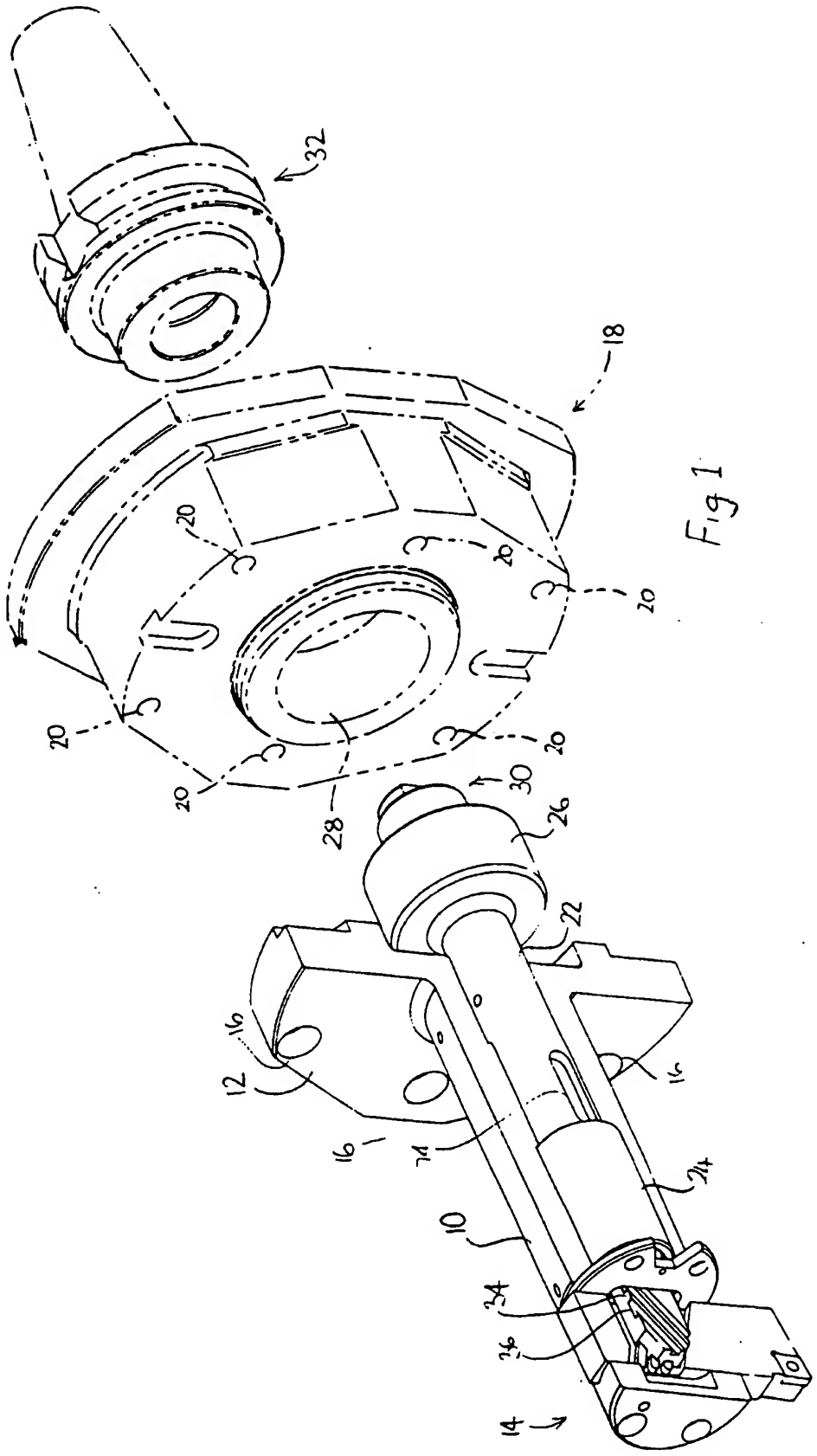
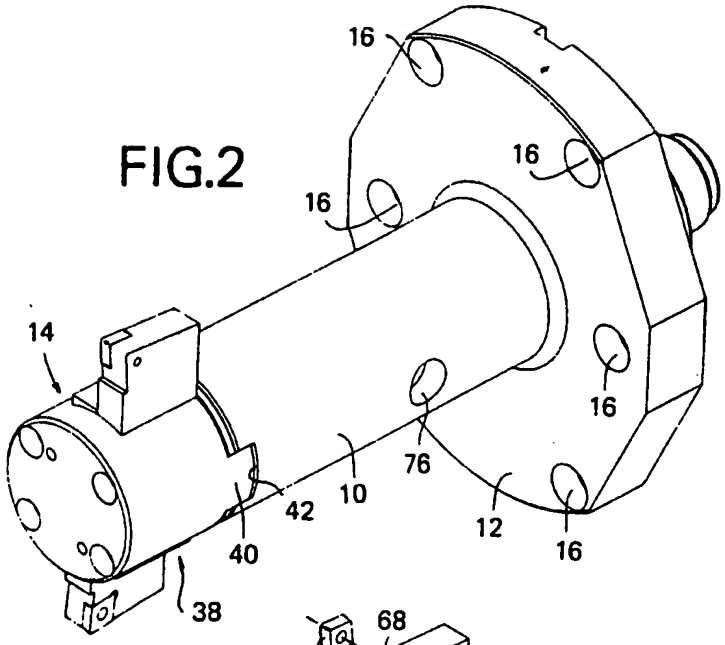


Fig 1

FIG.2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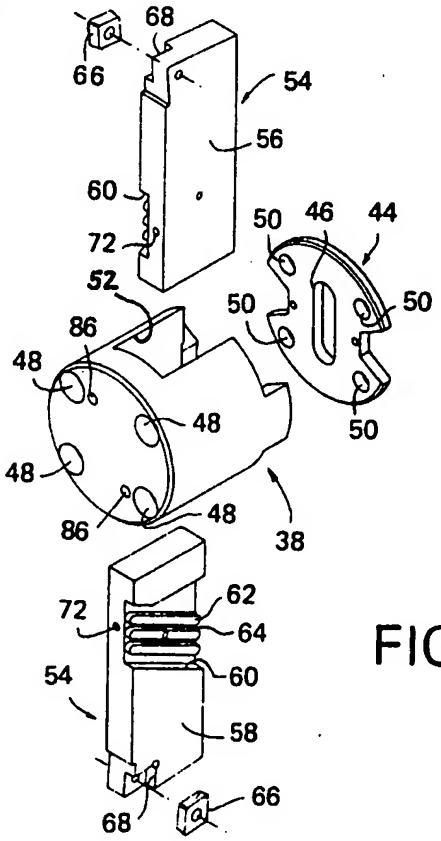
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66

FIG.3

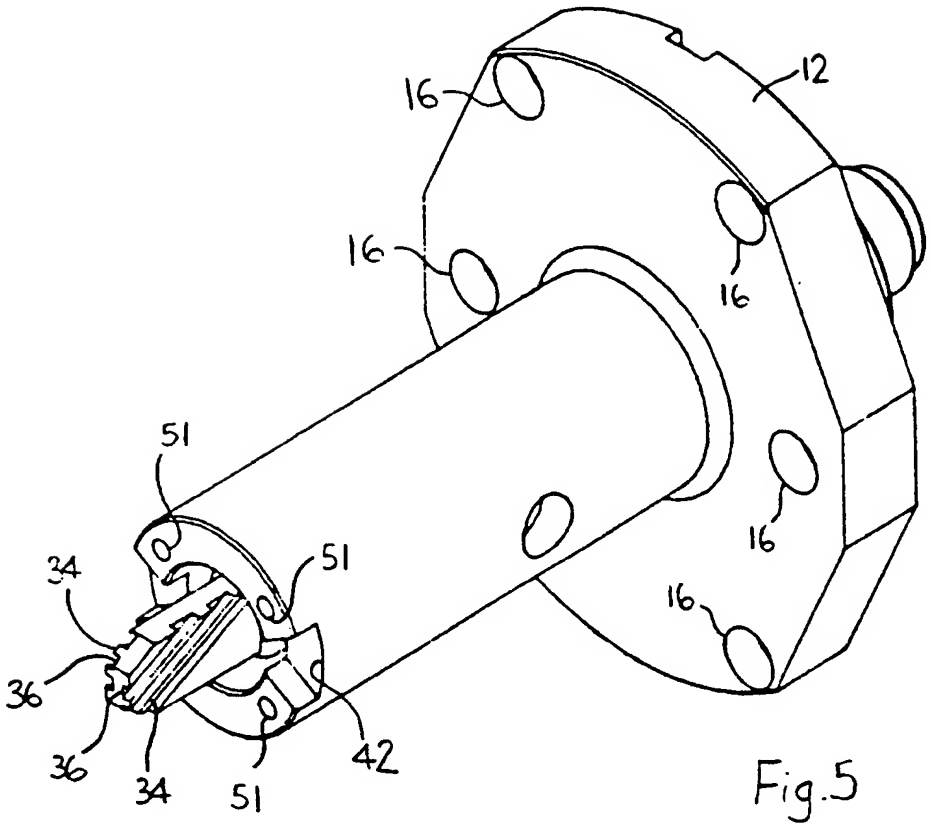
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Fig.5

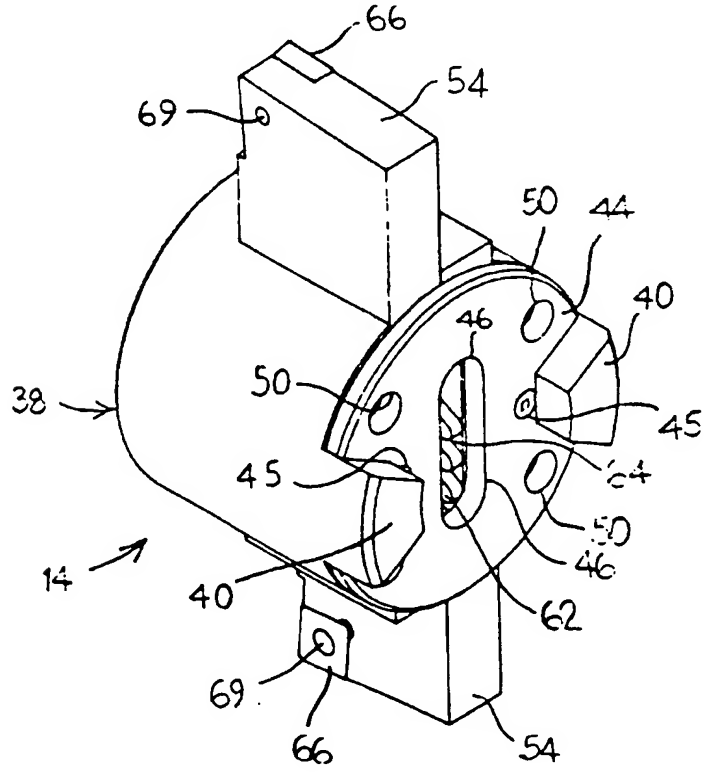
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Fig 4

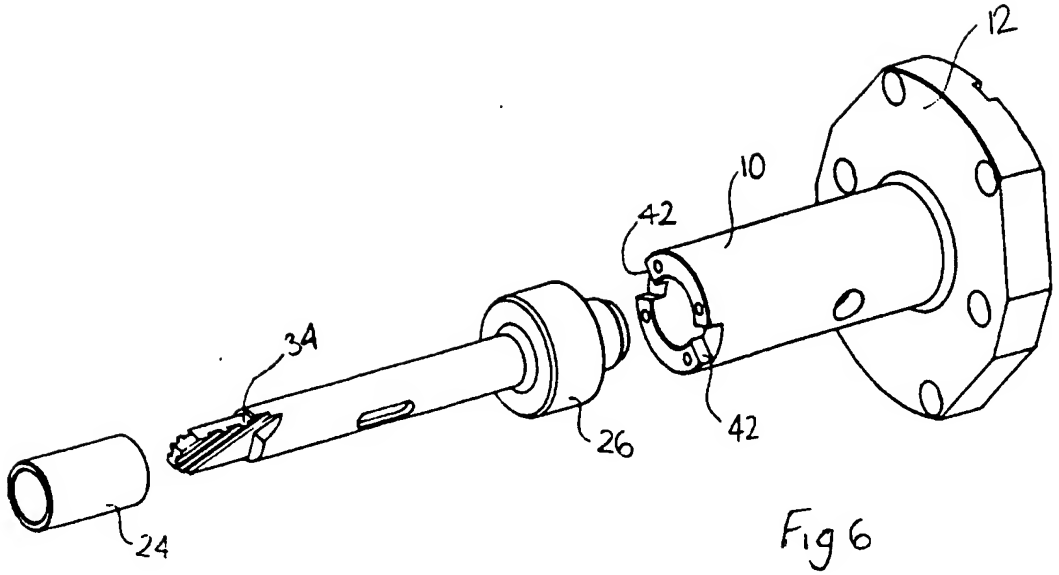

Fig 6

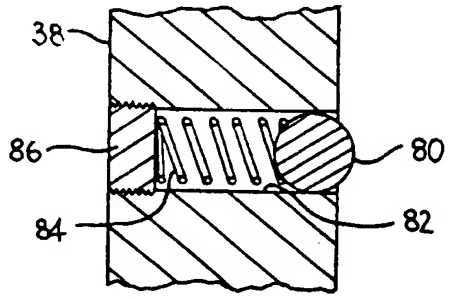

Fig. 7